



## U.S. DEPARTMENT OF COMMERCE PATENT &amp; TRADEMARK OFFICE 23364

B/O Form PTO-1390	<b>Transmittal Letter to the United States Designated/Elected Office (DO/EO/US) Concerning a Filing Under 35 USC 371</b>	Attorney's Docket Number MAYE3003/JEK U.S. Application Number (if known) <b>09/787919</b>
International Application Number PCT/EP99/07216		International Filing Date 29 September 1999
Title of Invention GRAVURE PROCESS FOR PRINTING ADJACENT COLOUR SURFACES WITH VARIOUS COLOUR COATING THICKNESSES		
Applicant(s) for DO/EO/US Karlheinz MAYER et al.		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items under 35 USC 371:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 USC 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371.
3. ☒ This express request to begin national examination procedures (35 USC 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 USC 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed 35 USC 371(c)(2).
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 USC 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 USC 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 USC 371(c)(4)). ( ☐ Executed ☒ Unexecuted )
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 USC 371(c)(5)).

Items 11 to 16 below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
  - ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: 1 sheet of formal drawings

Application Number (if Known) <b>09/787919</b>		International Application Number <b>PCT/EP99/07216</b>		Attorney's Docket Number <b>MAYE3003/JEK</b>	
				<b>Calculations</b>	<b>PTO USE ONLY</b>
17. The following fees are submitted: <b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> <input checked="" type="checkbox"/> Search report has been prepared by the EPO or JPO ..... \$860.00 <input type="checkbox"/> International Preliminary Examination Fee paid to USPTO (37 CFR 1.482) ..... \$690.00 <input type="checkbox"/> No International Preliminary Examination Fee paid to USPTO (37 CFR 1.482) but International Search Fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$710.00 <input type="checkbox"/> Neither International Preliminary Examination Fee (37 CFR 1.482) nor International Search Fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$1000.00 <input type="checkbox"/> International Preliminary Examination Fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00					
<b>ENTER APPROPRIATE BASIC FEE AMOUNT</b>				<b>\$ 860.00</b>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).					
<b>CLAIMS</b>	<b>NUMBER FILED</b>	<b>NUMBER EXTRA</b>	<b>RATE</b>		
Total Claims	37      -20 =	17	× \$18.00	\$ 306.00	
Independent Claims	3      -3 =		× \$80.00		
Multiple Dependent Claims (if applicable)			+ \$270.00	\$ 270.00	
<b>TOTAL OF ABOVE CALCULATIONS</b>				<b>\$ 1,436.00</b>	
Reduction by ½ for filing by small entity, if applicable. Small Entity Status is asserted pursuant to 37 CFR 1.27 for this application.					
<b>SUBTOTAL</b>				<b>\$ 1,436.00</b>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).					
<b>TOTAL NATIONAL FEE</b>				<b>\$ 1,436.00</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property.					
<b>TOTAL FEES ENCLOSED</b>				<b>\$ 1,436.00</b>	
				Amount to be:	Refunded:
					Charged:

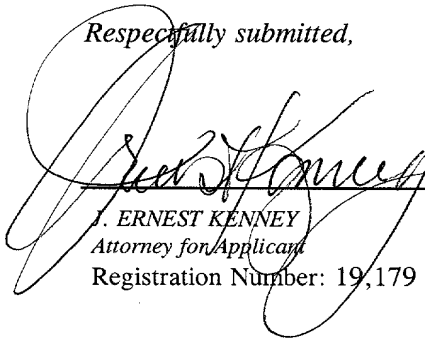
- a. ☒ A check in the amount of **\$1,436.00** to cover the fees is enclosed.
- b. ☐ Please charge my **Deposit Account Number 02-0200** in the amount of **\$** to cover the above fees.  
A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to **Deposit Account Number 02-0200**. A duplicate copy of this sheet is enclosed.

Note: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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DATE: 02 April 2001

Respectfully submitted,

  
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00/707010



23364

PATENT TRADEMARK OFFICE

532 Rec'd PCT.TTO PATENT 02 APR 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

International Patent Application  
No. PCT/EP99/07216

PCT/DO/EO/US

International Filing Date: 29 September 1999

Applicant: Karlheinz MAYER et al.

For: GRAVURE PROCESS FOR PRINTING ADJACENT COLOUR SURFACES  
WITH VARIOUS COLOUR COATING THICKNESSES

PRELIMINARY AMENDMENT

Commissioner for Patents  
Washington, D.C. 20231

Sir:

This paper accompanies documents submitted to establish the U.S. national stage of the above-identified international patent application.

The claims were not amended during the international phase. Before calculation of the filing fee and before examination, please amend the application as follows:

IN THE CLAIMS:

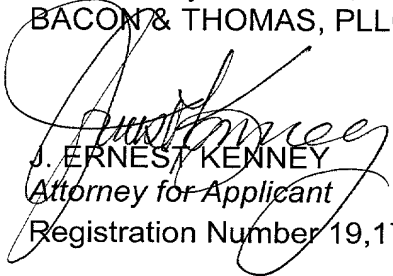
Please amend the original as-filed claims as shown on the appended APPENDIX OF CLAIMS, which includes amended and non-amended claims. Also appended hereto an APPENDIX OF MARKED UP CLAIMS showing the changes which have been made.

International Application No. PCT/EP99/07216

**REMARKS**

All rights are reserved to the original claimed subject matter. The claims have been amended to reduce the filing fees and to better conform to U.S. claim format. Examination of the application as amended is respectfully requested.

Respectfully submitted,  
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Date: April 2, 2001

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International Application No. PCT/EP99/07216

## APPENDIX OF CLAIMS

1(Amended). A data medium comprising a printed image produced by the intaglio printing process, said image comprising at least one first ink area with a first ink layer thickness and at least one second ink area with a second ink thickness adjacent to the first ink area, wherein the ink layer thicknesses are different, the first and second ink areas are directly adjacent to each other and are separated from each other by a sharp border line not visible to the naked eye, and that the ink layer thickness of both ink areas passes through a minimum in the region of the border line.

2(Amended). The data medium according to Claim 1, wherein the minimum is an ink layer thickness of almost zero.

3(Amended). The data medium according to Claim 1 or 2, wherein the first ink area and/or the second ink area represent a pattern, graphical symbol or text symbol.

4(Amended). A printing plate for the printing of adjacent ink areas, comprising a printing plate surface and engraved in the printing plate surface, at least one first engraving area with a first engraving depth and at least one second engraving area with a second engraving depth adjacent to the first engraving area, such that the engraving, depths are different, and wherein,

between the first and the second engraved areas, is arranged a separating edge the upper edge of which extends towards a point at the level of the printing plate surface.

5(Amended). The printing plate according to Claim 4, wherein

the separating edge has flank angles in the region between  $15^{\circ}$  and  $60^{\circ}$ , preferably between  $30^{\circ}$  and  $50^{\circ}$ , relative to the perpendicular to the printing plate surface.

6(Amended). The printing plate according to Claim 4 or 5, wherein the first and second engraving depths lie in the region between 5 and 250  $\mu\text{m}$ .

7(Amended). The printing plate according to Claim 6, wherein the first and second engraving depths lie in the region between 5 and 150  $\mu\text{m}$ .

8(Amended). The printing plate according to claim 4 or 5, wherein the first engraved area and/or the second engraved area are forms selected from the group consisting of a pattern, a graphical symbol and a text symbol.

9(Amended). The printing plate according to claim 4 or 5, wherein the first and/or the second engraved area have a floor area having a floor roughness pattern.

10(Amended). An intaglio printing process for the printing of adjacent ink areas with different ink layer thicknesses, using a printing plate according to claim 4 or 5 is used.

11(Amended). A process for the manufacture of a printing plate for the printing of adjacent ink areas with different ink layer thicknesses, comprising the following steps:

providing a printing plate with a printing plate surface and  
engraving a first engraving area with a first engraving depth and a second engraving area with a second engraving depth in the printing plate surface, such that between the first engraving area and the second engraving area, a separating edge remains, said separating edge having an upper edge which extends towards a point at the height of the printing plate surface.

12(Amended). The process according to Claim 11, wherein the separating edges are formed with flank angles in the region of  $15^{\circ}$  to  $60^{\circ}$ , preferably  $30^{\circ}$  to  $50^{\circ}$  relative to the perpendicular to the printing plate surface.

13(Amended). The process according to Claim 11 or 12, wherein an engraving tool with a suitable flank angle is used for engraving.

14(Amended). The process according to Claim 13, wherein a rotating graver coming to a point is used for engraving.

15(Amended). The process according to claim 11 or 12, wherein the engraving depths are created in the region from  $5\text{ }\mu\text{m}$  to  $250\text{ }\mu\text{m}$ .

16(Amended). The process according to Claim 15, wherein the engraving depths lie in the region from  $5\text{ }\mu\text{m}$  to  $150\text{ }\mu\text{m}$ .

17(Amended). The process according to claim 11 or 12, wherein in the first engraving area and/or in the second engraving area, a floor area with a floor roughness pattern is created.

18(Amended). The process according to claim 11 or 12, wherein several adjacent first engraving areas and one or more adjacent second engraving areas are engraved in the printing plate surface.

19(Amended). The process according to claim 11 or 12, wherein the first or the several first engraving areas and/or the second or the several second engraving areas are arranged in the form of a pattern, graphical symbol or text symbol.

20(New). A data carrier according to claim 1 or 2, wherein the ink areas are of linear or areal form.

21(New). The printing plate according to claim 4 or 5, wherein the engraved areas are formed by linear or areal depressions.

22(New). The process according to claim 11, including forming the engraved areas by linear or areal depressions.

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23364

PATENT TRADEMARK OFFICE

International Application No. PCT/EP99/07216

532 Rec'd PCT/EP 02 APR 2001

## APPENDIX OF MARKED UP CLAIMS

1(Amended). [Data] A data medium [(1) with] comprising a printed image produced by the intaglio printing process, said image comprising [having] at least one first ink area [(12a)] with a first ink layer thickness [(D<sub>a</sub>)] and at least one second ink area [(12b)] with a second ink thickness [(D<sub>b</sub>)] adjacent to the first ink area, [whereby] wherein the ink layer thicknesses [(D<sub>a</sub>, D<sub>b</sub>)] are different,

**[characterised in that]**

the first and second ink areas [(12a, 12b)] are directly adjacent to each other and are separated from each other by a sharp border line not visible to the naked eye, and that the ink layer thickness of both ink areas [(12a, 12b)] passes through a minimum in the region of the border line.

2(Amended). [Data] The data medium according to Claim 1, wherein

**[characterised in that]**

the minimum is an ink layer thickness of almost zero.

3(Amended). [Data] The data medium according to Claim 1 or 2, wherein

**[characterised in that]**

the first ink area [(12a)] and/or the second ink area [(12b)] represent a pattern, graphical symbol or text symbol.

4(Amended). [Printing] A printing plate [(1)] for the printing of adjacent ink areas [(12a, 12b)], [including] comprising a printing plate surface [(2)] and engraved in the printing plate surface [(2)], at least one first engraving area [(3a)] with a first engraving depth [(t<sub>a</sub>)] and at least one second engraving area [(3b)] with a second engraving depth [(t<sub>b</sub>)] adjacent to the first engraving area [(3a)], such that the engraving, depths [(t<sub>a</sub>, t<sub>b</sub>)] are different, and wherein,

**[characterised in that]**

between the first and the second engraved areas [(3a, 3b)], is arranged a separating edge [(5)] the upper edge [(6)] of which [runs] extends towards a point at the level of the printing plate surface [(2)].

5(Amended). [Printing] The printing plate according to Claim 4, wherein

**[characterised in that]**

the separating edge [(5)] has flank angles [(a)] in the region between 15° and 60°, preferably between 30° and 50°, relative to the perpendicular to the printing plate surface [(2)].

6(Amended). [Printing] The printing plate according to Claim 4 or 5, wherein

**[characterised in that ]**

the first and second engraving depths [(t<sub>a</sub>, t<sub>b</sub>)] lie in the region between 5 and 250 µm.

7(Amended). [Printing] The printing plate according to Claim 6, wherein

**[characterised in that ]**

the first and second engraving depths [(t<sub>a</sub>, t<sub>b</sub>)] lie in the region between 5 and 150 µm.

8(Amended). [Printing] The printing plate according to [at least one of the claims 4 to 7] claim 4 or 5, wherein

**[characterised in that ]**

the first engraved area [(3a)] and/or the second engraved area [(3b) form] are forms selected from the group consisting of a pattern, a graphical symbol [or] and a text symbol.

9(Amended). [Printing] The printing plate according to [at least one of the claims 4 to 8] claim 4 or 5, wherein

**[characterised in that ]**

the first and/or the second engraved area [(3a, 3b)] have a floor area [(7)] having a floor roughness pattern.

10(Amended). [Intaglio] An intaglio printing process for the printing of adjacent ink areas [(12a, 12b)] with different ink layer thicknesses [(D<sub>a</sub>, D<sub>b</sub>)], [whereby] using a printing plate according to [one of the claims 4 to 9] claim 4 or 5 is used.

11(Amended). [Process] A process for the manufacture of a printing plate [(1)] for the printing of adjacent ink areas [(12a, 12b)] with different ink layer thicknesses [(D<sub>a</sub>, D<sub>b</sub>)], [including] comprising the following steps:

[provision of] providing a printing plate [(1)] with a printing plate surface [(2)] and

engraving [of] a first engraving area [(3a)] with a first engraving depth [(t<sub>a</sub>)] and a second engraving area [(3b)] with a second engraving depth [(t<sub>b</sub>)] in the printing plate surface [(2)], such that between the first engraving area [(3a)] and the second engraving area [(3b)], a separating edge [(5)] remains, said separating edge having an upper edge [(6)] which [runs] extends towards a point at the height of the printing plate surface [(2)].

12(Amended). [Process] The process according to Claim 11, wherein

**[characterised in that]**

the separating [ridges] edges [(5)] are formed with flank angles [(α)] in the region of 15° to 60°, preferably 30° to 50° relative to the perpendicular to the printing plate surface.

13(Amended). [Process] The process according to Claim 11 or 12, wherein

**[characterised in that]**

an engraving tool with a suitable flank angle [(α)] is used for engraving.

14(Amended). [Process] The process according to Claim 13, wherein

**[characterised in that]**

a rotating graver coming to a point is used for engraving.

15(Amended). [Process] The process according to [at least one of the claims 11 to 14,] claim 11 or 12, wherein

**[characterised in that]**

the engraving depths  $[(t_a, t_b)]$  are created in the region from 5  $\mu\text{m}$  to 250  $\mu\text{m}$ .

16(Amended). [Process] The process according to Claim 15, wherein

**[characterised in that]**

the engraving depths  $[(t_a, t_b)]$  lie in the region from 5  $\mu\text{m}$  to 150  $\mu\text{m}$ .

17(Amended). [Process] The process according to [at least one of the claims 11 to 16,] claim 11 or 12, wherein

**[characterised in that]**

in the first engraving area  $[(3a)]$  and/or in the second engraving area  $[(3b)]$ , a floor area  $[(7)]$  with a floor roughness pattern is created.

18(Amended). [Process] The process according to [at least one of the claims 11 to 17,] claim 11 or 12, wherein

**[characterised in that]**

several adjacent first engraving areas  $[(3a)]$  and one or more adjacent second engraving areas  $[(3b)]$  are engraved in the printing plate surface  $[(2)]$ .

19(Amended). [Process] The process according to [at least one of the claims 11 to 18,] claim 11 or 12, wherein

**[characterised in that]**

the first or the several first engraving areas [(3a)] and/or the second or the several second engraving areas [(3b)] are arranged in the form of a pattern, graphical symbol or text symbol.

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Intaglio printing process for the printing of adjacent areas of ink of differing ink layer thickness

5 The invention concerns a data medium with a printed image produced by the intaglio printing process, with adjacent ink areas with different ink layer thicknesses, a intaglio printing process for the printing of adjacent ink areas, as well as printing plates for carrying out the intaglio process and a process for the manufacture of the printing plates.

10

A characteristic of intaglio printing is that in the printing - that is, the colour transferring - areas, the surface material of a printing plate is removed by means of a suitable engraving tool or by etching. Ink is applied to the finished printing plate and the surplus ink is removed from the surface of the printing plate before the actual printing procedure by means of a doctor blade or a wiping cylinder, so that the ink remains only in the depressions. Then a substrate, usually paper, is pressed against the printing plate and then pulled off again, so that the ink remains adhering to the substrate surface and forms a print image there. If translucent inks are used, the thickness of the ink application determines the colour tone.

20

With previous gravure printing techniques, a distinction has been drawn between rotogravure and intaglio printing. In the case of rotogravure, the printing plates are made by means, for instance, of an electron beam, laser beam or graver. It is a characteristic of photogravure that different grey or colour scale values in the printed image are created by cells regularly arranged in the printing plate with varying density, size and/or depth.

25

The intaglio printing technique, and especially the steelplate intaglio printing technique, is an important technique for the printing of data media, especially securities such as bank notes and the like. In comparison with other common printing techniques, such as offset printing, for instance, the intaglio printing process allows a very thick ink deposition onto data media. The relatively thick ink layer generated in the intaglio process is readily recognisable to the lay person as a simple authenticity feature, due to its tactile quality. This authenticity feature cannot easily be reproduced

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with a simple copy, so that the intaglio printing technique offers protection against simple forgeries.

Intaglio printing is distinguished by the fact that linear depressions are formed in the printing plates in order to create a print image. In the case of the mechanically produced intaglio printing plate, due to the normally conical shape of the engraving tool, increased engraving depth produces a broader line. Furthermore, the ink capacity of the engraved line and thus the opacity of the printed line increases with increasing line depth. For the etching of intaglio printing plates, the non-printing areas of the plate are covered with a chemically inert lacquer. During the subsequent etching, the engraving is created in the exposed areas of the plate, such that the depth and width of the engraved lines depend in particular on the etching duration.

A process is known from WO 97/48555, with which intaglio printing plates can be produced in a reproducible, mechanical manner. To that end, the lines on a line original are recorded and the area of every line is determined exactly. With an engraving tool, for instance a rotating graver or a laser beam, firstly the outer contour of this area is engraved, to provide a clean outline around the area. Next, the outlined region of the area is cleared out with the same or another engraving tool, so that the entire line is exactly engraved according to the line original. Depending on the shape and movement of the engraving tool, on the base of the cleared area, a floor roughness pattern is formed, which serves as an ink trap for the printing ink.

It is also possible, within a first engraved area, to engrave a second area with a greater engraving depth, so that, due to the different thicknesses of ink application, the printed image has two adjacent areas of differing colour intensity. Following the printing process, however, the differences of thickness become blurred, since the inks in the inked areas run into one another, with the result that a sharp optical separation between the inked areas in the printed image does not come about and thus no fine image structures can be reproduced.

It is therefore the aim of the present invention to provide measures that enable adjacent ink areas to be created with the intaglio printing process, which are clearly delimited from each other.

- 5 This aim is fulfilled according to the invention with the features of the non-dependent claims. Further developments of the invention are the subject of the subclaims.

Of essential importance is the fact that in order to create adjacent areas of ink, the engraved areas on the printing plate assigned to colour areas are separated from each other with a separating edge, which is pointed at the level of the plate surface. If a data  
10 medium, such as a bank note, is printed with a printing plate of this type, then adjacent areas of ink are created which pass through a minimum in the border region.

In an ideal case, the ink layer thickness is zero at the border line between the areas of  
15 ink. However, if the printing inks in the adjacent areas of ink join each other in the immediate region of the border, it can be slightly greater than zero. This is especially the case if the flanks of the separating edge are steep and have a small flank angle. The flatter the flanks of the separating edge, the more gradually the ink layer thickness tends to the ink layer minimum thickness in the edge region. In this way, a very fine  
20 lighter border line, only perceptible under magnification, for instance with a magnifying glass, can be formed between the adjacent ink areas, which can serve as an additional - on normal observation, hidden - security feature.

By means of the invention, it is possible for the first time to create immediately  
25 adjacent ink areas with differing layer thicknesses using the intaglio printing process, which do not run into one another and are clearly delimited from each other.

Depending on the engraving depth, in this way, different colour tones can be created with the same printing ink. Using commercially available intaglio printing inks,  
30 engraving depths in the region of 5 to 60  $\mu\text{m}$  lead to ink layers with a translucent, glazed colour appearance. In this connection, lighter colours are normally more strongly translucent than dark ones. With engraving depths of about 60 to 100  $\mu\text{m}$ , on the other hand, ink layers with a more opaque coloured appearance result. Thus, using



three different translucent printing inks, for instance, in combination with just two different engraving depths, six different colour tones can be produced in a single printing process. With an engraving depth of about 100  $\mu\text{m}$  and above, the ink layers thereby produced on a printed document can be easily felt, so that using the printing  
 5 plates according to the invention, not only the visual colour appearance, but also the tactile characteristics of a printed document can be specifically adjusted.

The invention is described in more detail below with the aid of figures. The figures are sketches illustrating the principle and are not reproduced to scale, particularly with  
 10 regard to the layer thicknesses.

They show the following:

Fig.1 Portion of a printing plate in cross-section.

Fig. 2 Portion of a data medium with two adjacent ink layers with differing ink layer thicknesses, shown schematically in cross-section.

Fig. 3 Portion of a data medium with two adjacent ink layers in cross-section.

Fig. 1 shows a printing plate 1 in cross-section with a printing plate surface 2, into which a first engraved area 3a with an engraving depth  $t_a$  and a second engraved area 3b with an engraving depth  $t_b$  are engraved. The two engraved areas 3a, 3b are immediately adjacent to each other at the level of the printing plate surface 2 and are  
 25 otherwise separated from each other by a separating edge 5 whose upper edge 6 is pointed at the level of the printing plate surface 2. The printing plate can also be designed so that the upper edge 6 lies slightly - that is a few  $\mu\text{m}$  - below the level of the printing plate surface 2. The flanks of the engraved areas 3a, 3b also simultaneously form the flanks of the separating edge and subtend a flank angle to the  
 30 perpendicular to the upper edge 6. In Fig.1, only the flank angle  $\alpha$  of the right flank of the separating edge is shown, since both the flank angles are equal in the example shown. The two flank angles of the separating edge 5 could, however, be made

different. The flank angles can lie within the range of  $15^\circ$  to  $60^\circ$ , and preferably lie between  $30^\circ$  and  $50^\circ$ .

- 5 Comparisons have shown that printing plates with the preferred flank angle in the range between  $30^\circ$  and  $50^\circ$  have better printing qualities. These include a good edge sharpness in the printed image and a reduced tendency to ink spattering, leading to bleeding of the edges in the printed areas on the printed object.

- 10 The floor surfaces 7a and 7b of the engraved areas 3a, 3b can be flat (7a) or have a floor roughness pattern (7b). The floor roughness pattern is advantageous since the printing ink is held better on the floor of the engraving. The engraved areas 3a and 3b can also converge to a point at the bottom, so that they have no floor surface (not shown).

- 15 The engraving depth  $t$  of the engraved areas 3a, 3b lies in the region between  $5\text{ }\mu\text{m}$  and  $250\text{ }\mu\text{m}$ , and preferably in the range between  $5\text{ }\mu\text{m}$  and  $150\text{ }\mu\text{m}$ .

- 20 The engraved plates are also suitable for duplication by means of conventional moulding techniques for intaglio printing plates. In this way, the engraved original is reproduced multiple times by means of intermediate steps and only the reproductions used as printing forms. Engravings with the preferred flank angles and engraving depths have proved particularly advantageous for the moulding and separation procedures required for reproduction.

- 25 Fig. 2 shows a portion of a data medium 10 with a printed image including two ink areas 12a, 12b, shown in a schematically simplified form. The data medium 10 was printed with a printing plate 1 as shown in Fig. 1, using the intaglio printing process. During the printing process, the data medium 10 is pressed into the engraved areas 3a, 3b, such that on the underside 17 of the data medium, depressions 11a, 11b can remain
- 30 lastingly. The upper surface 15 of the data medium has raised parts in the areas 11a, 11b, such that these raised parts are covered with ink layers 13a, 13b, which were taken up by the upper surface 15 of the data medium from the engraved areas 3a, 3b. The ink layers 13a, 13b form the ink areas 12a, 12b with their surfaces. The ink layer

thickness  $D_a$ ,  $D_b$  is given by the level difference between the unprinted substrate surface and the surfaces of the respective ink areas 12a, 12b. In the border region B, the ink layer thicknesses  $D_a$  and  $D_b$  decrease continually towards a border line, which is defined by the upper edge 6 of the separating edge 5 of the printing plate 1.

- 5 Depending on the flank angle  $\alpha$  chosen and according to the engraving depth  $t$ , a more or less wide border region B is formed. Since the ink layer thicknesses  $D_a$  and  $D_b$  in the border region B decrease continually, by suitable choice of the flank angle  $\alpha$ , a border line of light colour tone can be formed that is not discernible with the unaided human eye.

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Ideally, the ink layer thicknesses  $D_a$  and  $D_b$  reduce at the border line to a minimum ink layer thickness of 0. However, slight combination of the ink areas 12a, 12b can take place without any discernible colour mixing taking place. Fig. 3 illustrates this case. It can be seen that at the border line 16, combination of the ink areas 12a and 12b has

15 taken place.

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The ink layers 13a and 13b can consist of printing inks of different colour, since mixing of the inks in different engraving areas is practically non-existent, because of the design of the printing plate according to the invention. If, however, the same

20 translucent printing ink is used for the adjacent engraved areas 3a, 3b with different engraved depths  $t_a$ ,  $t_b$ , the ink layers 13a and 13b produce different colour tones in the printed image.

20

The adjacent engraved areas can be made up of lineshaped or planiform depressions.

25

The depressions are preferably engraved with a rotating graver having a flank angle corresponding to the required flank angle of the separating edge. Alternatively, the engraving graver can also be moved along paths forming two systems. The curves or straight lines of a system run parallel to each other and cross the curves or straight lines of the second system at regular intervals. In this way, a floor roughness pattern in

30 the form of a grid pattern with particularly favourable ink trapping properties is formed. Preferably, the graver comes to a point or has a special contour which allows a floor roughness pattern to be created on the floor surface of the engraving, this serving as an ink trap. To this end, the graver is moved at regular, small distances

30

parallel to a previously engraved path, so that the previously engraved depression is widened by this distance. The engraving depth lies in the region of 5 to 250  $\mu\text{m}$ , and preferably 5 to 150  $\mu\text{m}$ .

- 5 The preferred flank angle in the region of  $30^\circ$  to  $50^\circ$  enables a longer working life for the engraving tool, while simultaneously producing an excellent printing result from the engraved printing plate. Tools with flank angles in the region of  $30^\circ$  are particularly suited to the engraving of fine filigree and small-area structures, while for the engraving of large-area and coarser structures, tools with flank angles of  $40^\circ$  to  
10  $50^\circ$  are preferable.

- One or more lineshaped or planiform depressions can represent a pattern, a graphical symbol or a text symbol. Multiple adjacent depressions can form a regular grid, so that the printed image produced appears homogeneous, whereby the grid creates a fine  
15 structure in the printed image, which is only perceptible using magnifying devices.

Claims

1. Data medium (1) with a printed image produced by the intaglio printing process,  
having at least one first ink area (12a) with a first ink layer thickness ( $D_a$ ) and at  
5 least one second ink area (12b) with a second ink thickness ( $D_b$ ), adjacent to the  
first ink area, whereby the ink layer thicknesses ( $D_a$ ,  $D_b$ ) are different,  
**characterised in that**  
the first and second ink areas (12a, 12b) are directly adjacent to each other and  
are separated from each other by a sharp border line not visible to the naked eye,  
10 and that the ink layer thickness of both ink areas (12a, 12b) passes through a  
minimum in the region of the border line.
2. Data medium according to Claim 1,  
**characterised in that**  
15 the minimum is an ink layer thickness of almost zero.
3. Data medium according to Claim 1 or 2,  
**characterised in that**  
the first ink area (12a) and/or the second ink area (12b) represent a pattern,  
20 graphical symbol or text symbol.
4. Printing plate (1) for the printing of adjacent ink areas (12a, 12b), including a  
printing plate surface (2) and engraved in the printing plate surface (2), at least  
one first engraving area (3a) with a first engraving depth ( $t_a$ ) and at least one  
25 second engraving area (3b) with a second engraving depth ( $t_b$ ) adjacent to the  
first engraving area (3a), such that the engraving depths ( $t_a$ ,  $t_b$ ) are different,  
**characterised in that**  
between the first and the second engraved areas (3a, 3b), is arranged a separating  
edge (5) the upper edge (6) of which runs towards a point at the level of the  
30 printing plate surface (2).
5. Printing plate according to Claim 4,  
**characterised in that**

the separating edge (5) has flank angles ( $\alpha$ ) in the region between 15° and 60°, preferably between 30° and 50°, relative to the perpendicular to the printing plate surface (2).

- 5     6.     Printing plate according to Claim 4 or 5,  
**characterised in that**  
the first and second engraving depths ( $t_a$ ,  $t_b$ ) lie in the region between 5 and 250  $\mu\text{m}$ .
- 10    7.     Printing plate according to Claim 6,  
**characterised in that**  
the first and second engraving depths ( $t_a$ ,  $t_b$ ) lie in the region between 5 and 150  $\mu\text{m}$ .
- 15    8.     Printing plate according to at least one of the claims 4 to 7,  
**characterised in that**  
the first engraved area (3a) and/or the second engraved area (3b) form a pattern, a graphical symbol or a text symbol.
- 20    9.     Printing plate according to at least one of the claims 4 to 8,  
**characterised in that**  
the first and/or the second engraved area (3a, 3b) have a floor area (7) having a floor roughness pattern.
- 25    10.    Intaglio printing process for the printing of adjacent ink areas (12a, 12b) with different ink layer thicknesses ( $D_a$ ,  $D_b$ ), whereby a printing plate according to one of the claims 4 to 9 is used.
- 30    11.    Process for the manufacture of a printing plate (1) for the printing of adjacent ink areas (12a, 12b) with different ink layer thicknesses ( $D_a$ ,  $D_b$ ), including the following steps:
  - Provision of a printing plate (1) with a printing plate surface (2) and

- 5        - Engraving of a first engraving area (3a) with a first engraving depth ( $t_a$ ) and a second engraving area (3b) with a second engraving depth ( $t_b$ ) in the printing plate surface (2), such that between the first engraving area (3a) and the second engraving area (3b), a separating edge (5) remains, having an upper edge (6) which runs towards a point at the height of the printing plate surface (2).

- 10       12. Process according to Claim 11,  
       **characterised in that**  
       the separating ridges (5) are formed with flank angles ( $\alpha$ ) in the region of  $15^\circ$  to  $60^\circ$ , preferably  $30^\circ$  to  $50^\circ$  relative to the perpendicular to the printing plate surface.

- 15       13. Process according to Claim 11 or 12,  
       **characterised in that**  
       an engraving tool with a suitable flank angle ( $\alpha$ ) is used for engraving.

- 20       14. Process according to Claim 13,  
       **characterised in that**  
       a rotating graver coming to a point is used for engraving.

- 25       15. Process according to at least one of the claims 11 to 14,  
       **characterised in that**  
       the engraving depths ( $t_a$ ,  $t_b$ ) are created in the region from  $5\text{ }\mu\text{m}$  to  $250\text{ }\mu\text{m}$ .

- 30       16. Process according to Claim 15,  
       **characterised in that**  
       the engraving depths ( $t_a$ ,  $t_b$ ) lie in the region from  $5\text{ }\mu\text{m}$  to  $150\text{ }\mu\text{m}$ .

17. Process according to at least one of the claims 11 to 16,  
       **characterised in that**

in the first engraving area (3a) and/or in the second engraving area (3b), a floor area (7) with a floor roughness pattern is created.

18. Process according to at least one of the claims 11 to 17,

characterised in that

several adjacent first engraving areas (3a) and one or more adjacent second engraving areas (3b) are engraved in the printing plate surface (2).

19. Process according to at least one of the claims 11 to 18,

characterised in that

the first or the several first engraving areas (3a) and/or the second or the several second engraving areas (3b) are arranged in the form of a pattern, graphical symbol or text symbol.



FIG. 1

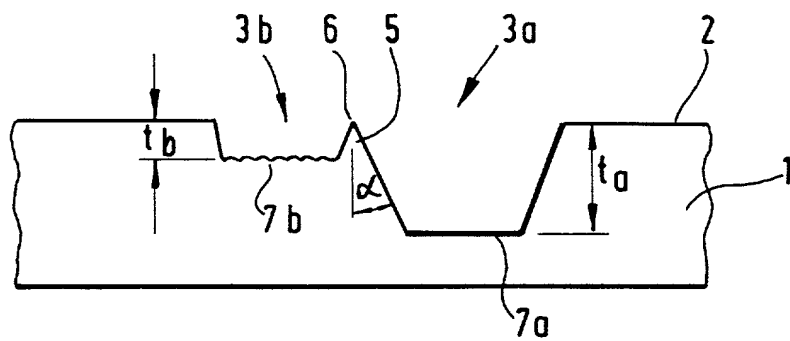


FIG. 2

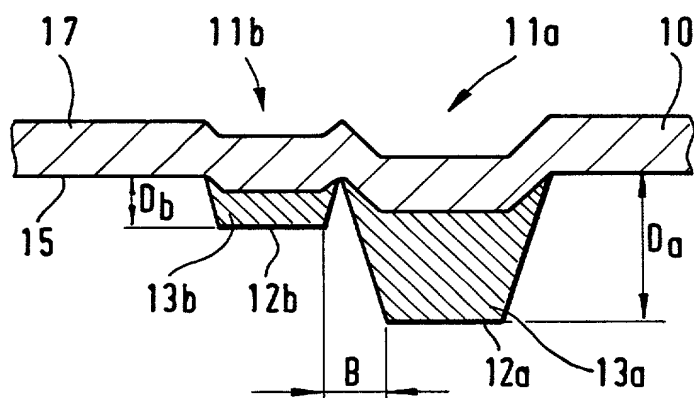
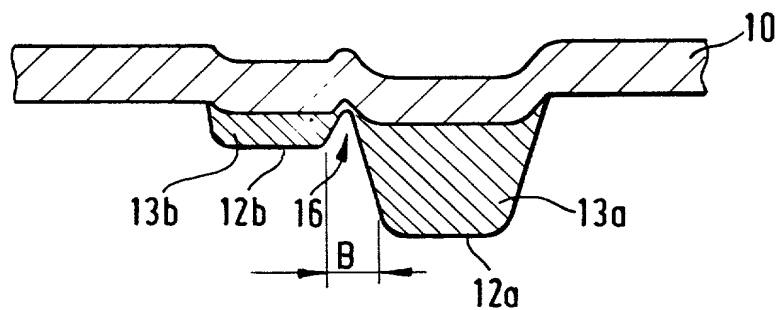


FIG. 3



**DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY**

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention (Design, if applicable) entitled: **GRAVURE PROCESS FOR PRINTING ADJACENT COLOUR SURFACES WITH VARIOUS COLOUR COATING THICKNESSES**

the specification of which (check one):

☐ is attached hereto, or ☒ was filed on: **29 September 1999**

as U.S. Application Number or PCT

International Application Number: **(PCT/EP99/07216) 09/787,919**

and (if applicable) was amended on:

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56*. I hereby claim foreign priority benefits under *Title 35, United States Code §119* of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No
198 45 436.8	Germany	02 October 1998	X	

☐ Additional Priority Application(s) Listed on Following Page(s)

**I HEREBY CLAIM THE BENEFIT UNDER TITLE 35 U.S. CODE §119(E) OF ANY U.S. PROVISIONAL APPLICATIONS LISTED BELOW.**

Application Number	Day/Month/Year Filed

☐ Additional Provisional Application(s) Listed on Following Page(s)

I hereby claim the benefit under *Title 35, United States Code, §120* of any United States application(s) or PCT international application(s) designating The United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of *Title 35, United States Code, §112*, I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56* which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Application Number	Filing Date	Status - Patented, Pending or Abandoned

☐ Additional US/PCT Priority Application(s) listed on Following Page(s)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under *section 1001 of title 18 of the United States Code* and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: I (We) hereby appoint as my (our) attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: J. Ernest Kenney, Reg. No. 19,179; Eugene Mar, Reg. No. 25,893; Richard E. Fichter, Reg. No. 26,382; Thomas J. Moore, Reg. No. 28,974; Joseph DeBenedictis, Reg. No. 28,502; Benjamin E. Úrcia, Reg. No. 33,805; and

I(we) authorize my(our) attorneys to accept and follow instructions from Klunker, Schmitt-Nilson, Hirsch regarding any matter related to the preparation, examination, grant and maintenance of this application, any continuation, continuation-in-part or divisional based thereon, and any patent resulting therefrom, until I(we) or my(our) assigns withdraw this authorization in writing.

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DATE	SIGNATURE <b>[Signature]</b>

☒ See following page(s) for additional joint inventors.

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CONTINUATION OF DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

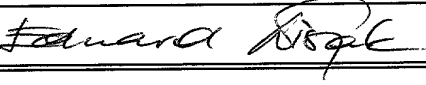
Page 2


PRIOR FOREIGN APPLICATION(S) (35 USC §119)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No

PRIOR PROVISIONAL APPLICATIONS 35 U.S. CODE §119(E)	
Application Number	Day/Month/Year Filed

PRIOR U.S. OR PCT INTERNATIONAL APPLICATIONS (35 U.S. CODE §120)		
Application Number	Filing Date	Status - Patented, Pending or Abandoned

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DATE <b>05.02.2001</b>	SIGNATURE 	

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DATE <b>05.02.2001</b>	SIGNATURE 	

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DATE <b>05.15.2001</b>	SIGNATURE 	

FULL NAME OF JOINT INVENTOR		CITIZENSHIP
RESIDENCE ADDRESS		POST OFFICE ADDRESS IS THE SAME AS RESIDENCE ADDRESS UNLESS OTHERWISE SHOWN BELOW
DATE	SIGNATURE	

☐ See following pages for additional joint inventors/priority applications.